ANGULAR DISTRIBUTION OF PROTONS FROM THE D-D REACTION AT 10 MEV

BY

HOWARD ALLEN LEITER

A.B., Miami University, 1940
A.M., University of Illinois, 1942

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS
IN THE GRADUATE COLLEGE OF THE
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ANGULAR DISTRIBUTION OF PROTONS FROM THE D - D REACTION AT 10 MEV

The study of the angular distribution of the disintegration products of nuclear reactions yields information about the character of the nuclear forces involved. Reactions between the simpler systems are best for this study, and the reaction which occurs when deuterons are bombarded with deuterons follows proton-proton and deuteron-proton scattering in this respect.

The angular distribution of the protons from the reaction $H^2 + H^2 \rightarrow H^3 + H^1$ has been measured using a gas-filled scattering chamber with photographic plates as detectors. Elastically scattered deuterons, H^3 from the above reaction, and He^3 from the other possible reaction were prevented from reaching the plates by an aluminum foil covering the emulsion.

The solid angle geometry was determined by an annular defining slit, the area on the photographic plates in which the protons were recorded, and the relative location of the slit, the area examined, and the position of this area on the plate. The plates and slit were so arranged that all laboratory angles from 12.5° to 65° were recorded simultaneously. The unscattered beam of deuterons was collected in a Faraday cage after passing through the chamber and the total charge measured with a low-current integrator circuit.

A background correction due to the flux of neutrons through the chamber was determined from experimental runs in which the protons produced in the beam were prevented from reaching the photographic plates. A second correction for the penetration of particles through the edges of the defining slit was calculated from the criterion of minimum acceptable length of track used in counting.

With deuterium at a pressure of approximately 5 cm of mercury in the chamber and a beam of approximately 2×10^{-9}

amperes of deuterons from the cyclotron into the chamber, the following differential cross sections in the center of mass system were obtained: 1.62 ± 0.052, 0.968 ± 0.031, 0.452 ± 0.015, 0.274 ± 0.009, 0.258 ± 0.008, 0.331 ± 0.011, 0.400 ± 0.013, 0.458 ± 0.015, 0.460 ± 0.015, 0.458 ± 0.015, $0.446 \pm 0.015 \times 10^{-26}$ cm^2 at angles in the center of mass system of 21° 23′, 28° 26′, 35° 27′, 42° 24′, 49° 15′, 56° 1′, 62° 40′, 69° 12′, 75° 36′, 81° 50′, 87° 54′ respectively.

VITA

Howard Allen Leiter was born on February 16, 1918 in Mt. Gilead, Ohio. He attended Miami University at Oxford, Ohio where he received the A. B. degree magna cum laude with Honors in Physics in 1940. From 1940 to 1942 he held a teaching assistantship in Physics at the University of Illinois and received the A. M. degree in Physics in 1942. From 1942 to 1946 he was a staff member of the Radiation Laboratory, Massachusetts Institute of Technology, where he was engaged in research and development work on R. F. components, especially transmit-receive switching devices, for microwave radar equipment.

From 1946 to 1948 he again held a teaching assistantship at the University of Illinois, and since July, 1948 has been a Special Research Assistant. He is a member of Phi Beta Kappa, Phi Kappa Phi, Sigma Xi, and the American Physical Society.

At M. I. T. he was the author or co-author of the following:

Dielectric Transmission Measurements, M. I. T. RL Report No. 53-13(1943).

The 1B27 TR Tube, M. I. T. RL Report No. 594(1945) (With L. D. Smullin).

A Microwave Bandpass Filter in Waveguide, M. I. T. RL Report No. 814(1945).

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